CASE STUDY: BROWNFIELD REDEVELOPMENT - PETROCHEMICALS COMPLEX

- ❑ LARGE CAPITAL PROJECT
- ❑ MARCELLUS SHALE GAS REGION

PRESENTED TO AHMP NATIONAL CONFERENCE, WASHINGTON DC

August 2016

AGENDA

- Project Overview of Potential Plant
- Redevelopment Plan
- Former Zinc Smelter
- Pennsylvania's Act 2
- Land Recycling Activities
- Benefits

DEFINITIONS AND CAUTIONARY NOTE

Reserves: Our use of the term “reserves” in this presentation means SEC proved oil and gas reserves.

Resources: Our use of the term “resources” in this presentation includes quantities of oil and gas not yet classified as SEC proved oil and gas reserves. Resources are consistent with the Society of Petroleum Engineers 2P and 2C definitions.

Organic: Our use of the term Organic includes SEC proved oil and gas reserves excluding changes resulting from acquisitions, divestments and year-average pricing impact.

Shales: Our use of the term ‘shales’ refers to tight, shale and coal bed methane oil and gas acreage.

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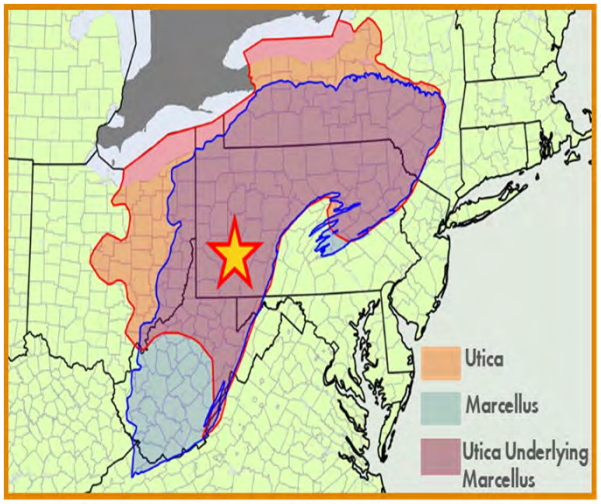
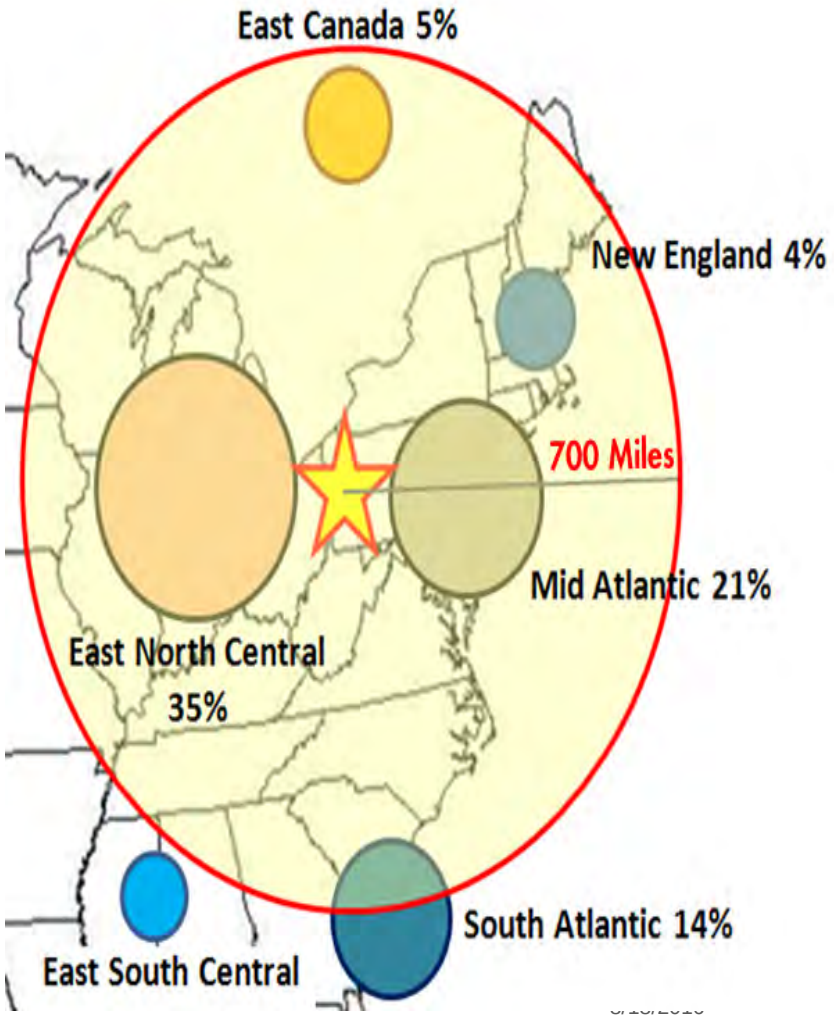
Located in sweet spot of ethane production and PE consumption

- Advantaged local feed supply
- Close proximity to market
- Strong local and regional support
- Benefits local and regional economies

Utica and Marcellus Shale Basin



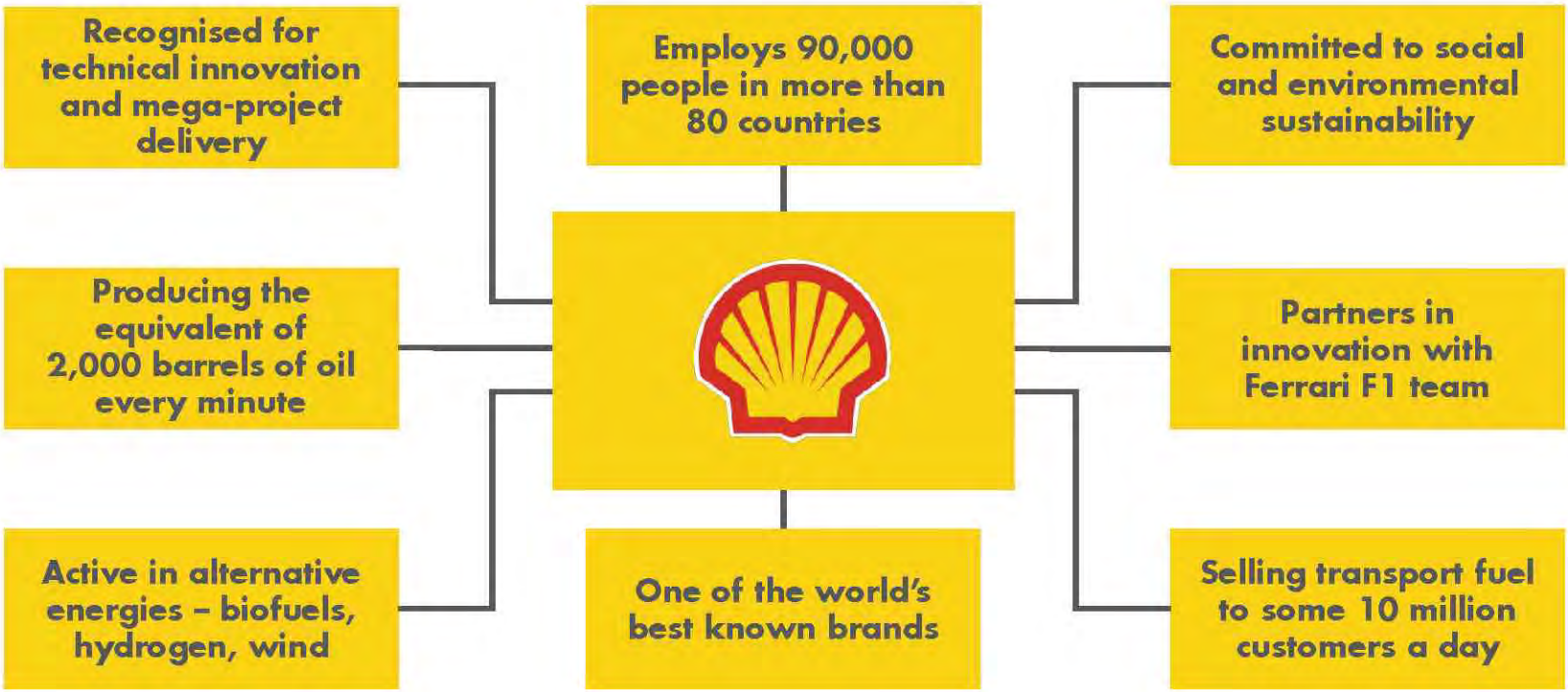
Northeast Regional Demand



Site Preparation began in June of 2015

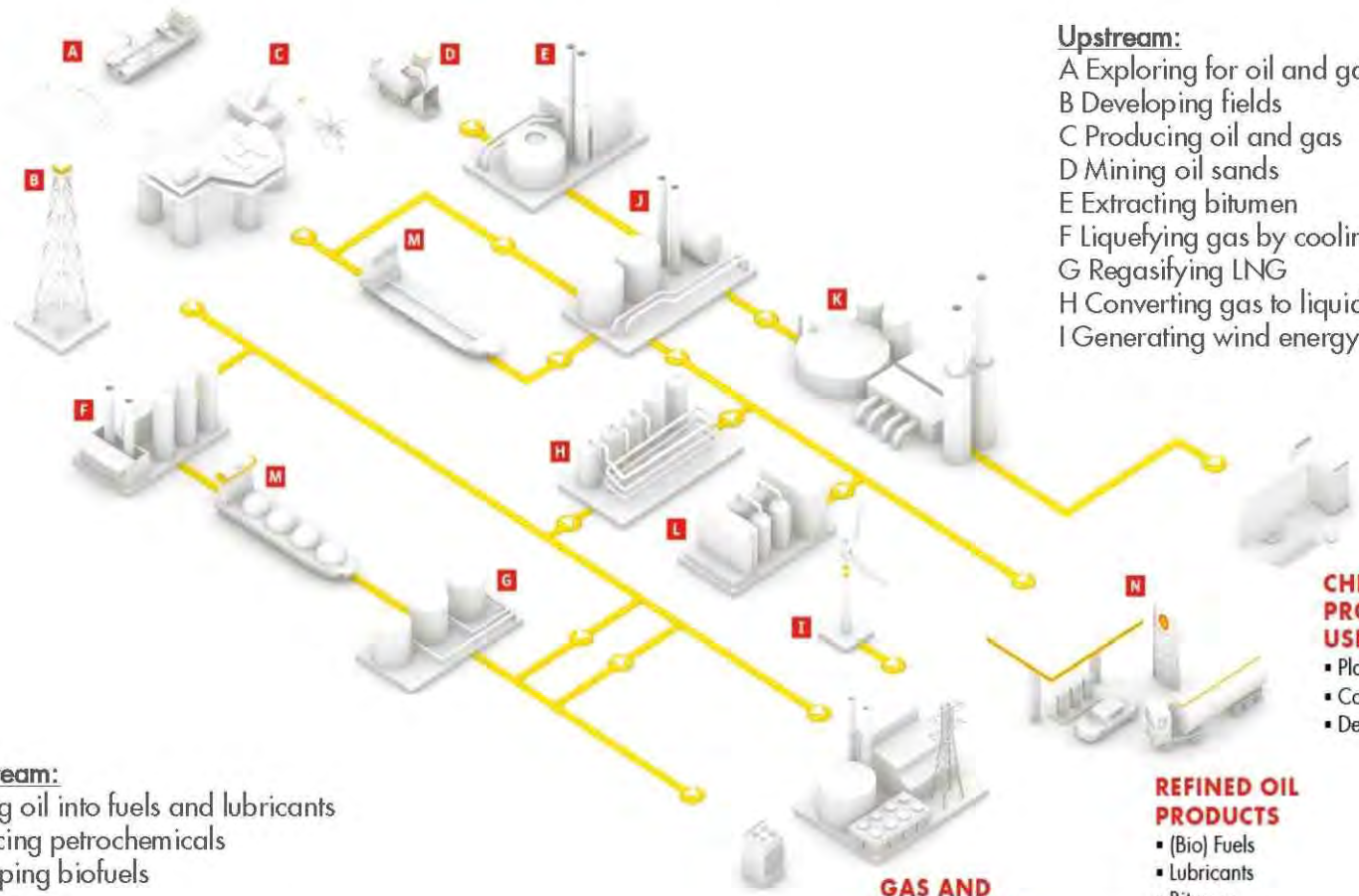
- Moving 7.2M cubic yards of dirt to cap the site in accordance to the approved Act 2 closure plan
- Completed heavy haul bridge to eliminate traffic exposure
- Relocation of CSX rail line and SR 18 to increase constructible footprint
- Construction of Load On Load Off dock
- Main construction to begin in 18 months

About Shell



Our businesses

Upstream refers to the ways we find and extract crude oil, natural gas and oil sands.
Downstream refers to the ways we transform them into products.



Upstream:
A Exploring for oil and gas
B Developing fields
C Producing oil and gas
D Mining oil sands
E Extracting bitumen
F Liquefying gas by cooling (LNG)
G Regasifying LNG
H Converting gas to liquid products (GTL)
I Generating wind energy

Downstream:
J Refining oil into fuels and lubricants
K Producing petrochemicals
L Developing biofuels
M Trading
N Retail sales

Hydrocarbon Molecules 101

- At its most basic level, the Oil and Gas business discovers, harnesses and processes hydrocarbon molecules.
- As the name suggests, the molecules are a combination of hydrogen and carbon, and they come in many forms throughout our environment.

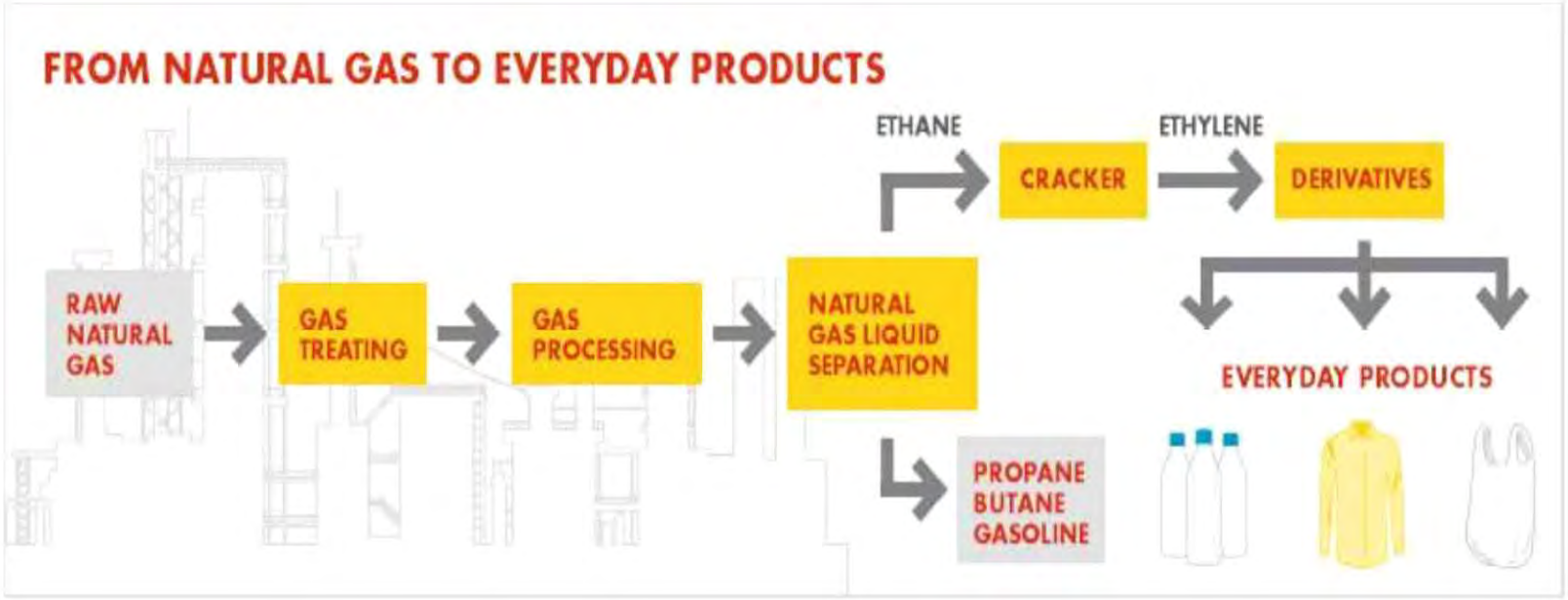
Rearrangement of Hydrocarbons: Gas, Plastics, Roads

- In the Downstream part of the oil and gas business, hydrocarbon molecules go through various processes to rearrange those molecules so they take on different forms that make them useful to customers.



- From asphalt roads to gasoline to common household products, rearranged hydrocarbon molecules are what power and supply much of modern society.

Hydrocarbon's Journey from Natural Gas to Everyday Products



Ethane-Ethylene-Polyethylene

- Heat, chemistry, pressure and cooling applied to ethane produces ethylene, the building block of polyethylene, one of the most common plastics.

Ethane Cracker – How it Looks and Operates

Ethane is heated, molecules are "cracked"

Cracking furnaces: 1600 F, low pressure (20-25 psig)

Pressure is applied to cracked gas

Compression: pressure (~600 psig)

Hydrogen

Fuel gas

Ethylene

Propane & heavier

Cooling at -100 F creates chemical separation

Polyethylene (PE) – Brings ethylene to market

Ethylene

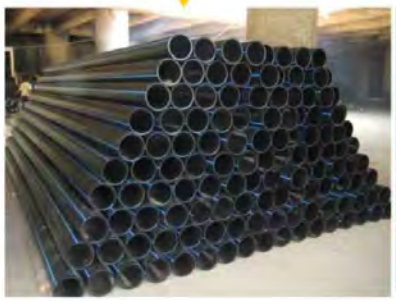
Related Hydrocarbon

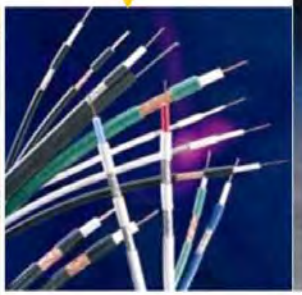
Polyethylene resin

Pipe

Coatings

Film





ELEMENTS OF SITE REDEVELOPMENT

- Relocate State Highway and interchange
- Relocate a railroad track
- Grading two hills and use clean fill to cover site
- Sections of two streams culverted
- Consolidation of materials under caps (soil and geosynthetic)
- Groundwater monitoring
- Recycling the land in accordance with Pennsylvania's Act 2

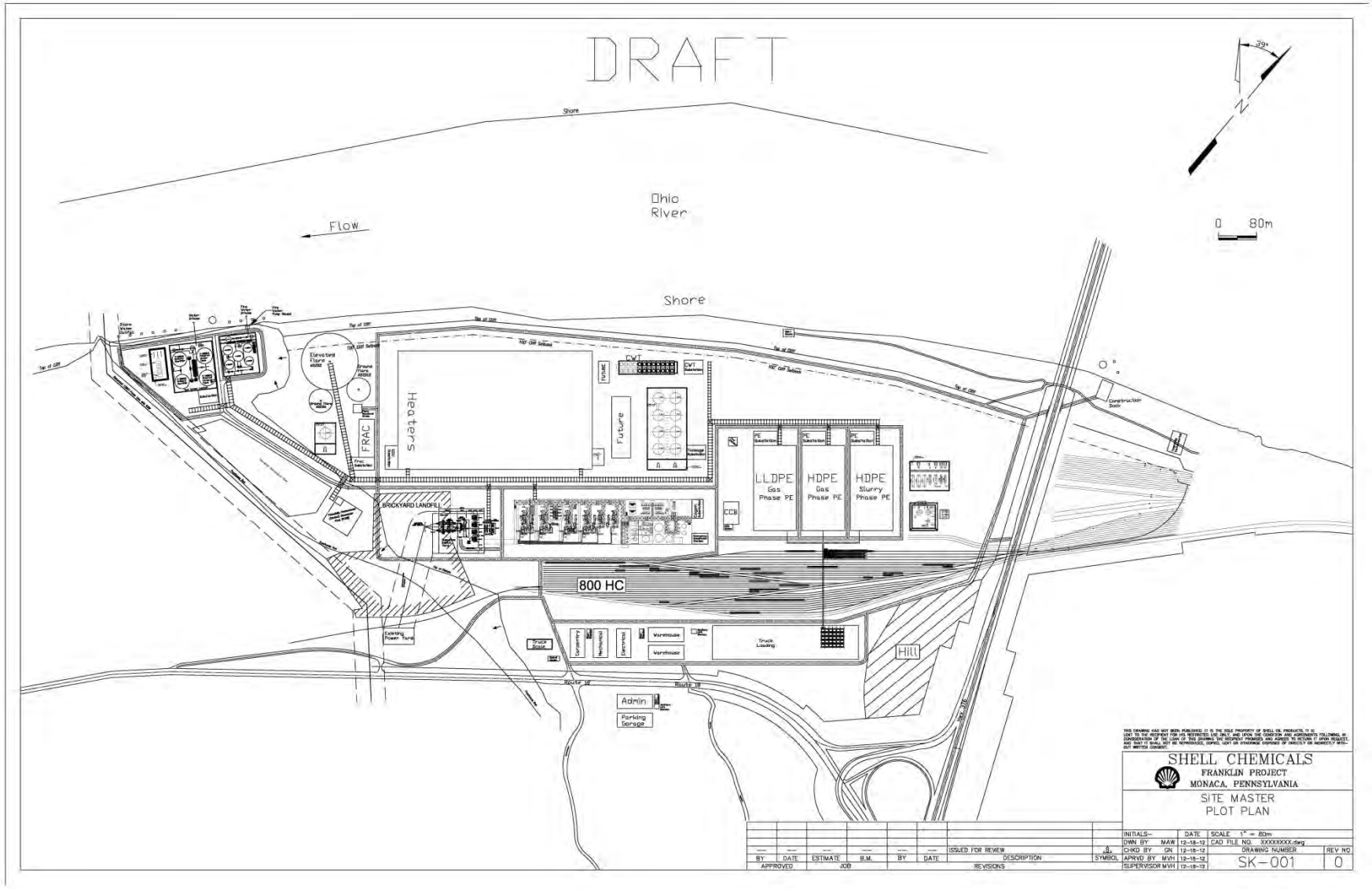
FORMER ZINC SMELTER

FORMER ZINC SMELTER

FORMER ZINC SMELTER

AERIAL VIEW OF FORMER ZINC SMELTER

DRAFT PLOT PLAN



ACT 2 - PA LAND RECYCLING PROGRAM

- Three standards available:
- Background Standard
- Statewide Health Standard
- Site-Specific Standard
  - Point of compliance for SHS and SSS is down-gradient property boundary

BACKGROUND STANDARD

- Intended for sites with no on-site sources
- Requires off-site sampling and statistical analysis
- Less often used in Pennsylvania than other standards

STATEWIDE HEALTH STANDARD

- Utilizes standards based on generic assumed exposure conditions
- Does not require a Risk Assessment or Work Plan
- Only one report required (a Final Report)
- 8 quarters of attainment sampling required for ground water
- Off-site evaluation not necessary

SITE-SPECIFIC STANDARD

- Utilizes risk-based standard based on actual site-specific exposure conditions – either numeric values or pathway elimination
- Requires a Remedial Investigation Report, Risk Assessment, and Work Plan (usually submitted simultaneously) and a Final Report after remedy implementation
- RI Report must present site characterization for affected media and demonstrate delineation of contamination
- Risk Assessment must evaluate potential exposure pathways. For groundwater, these typically include:
  - Ingestion/direct contact
  - Volatilization to indoor/outdoor air
  - Discharge to surface water

SITE-SPECIFIC STANDARD (CONT.)

- Work Plan presents details of selected approach with supporting data
- Groundwater Sampling (as approved by PADEP)
- Deed restrictions/environmental covenants
- Allows for risk-based goals and usually shorter timeframe

THE GENERAL ACT 2 PROCEDURE

- Identify and characterize property
- Establish the points of compliance
- Submit Notice to PADEP if applying background or site-specific standards
- Conduct Redevelopment activities
- Demonstrate Attainment
- Submit Final Report to PADEP
- Obtain Liability Relief with PADEP approval of final report
- Deed Acknowledgement and/or land use restriction, if applicable

LAND RECYCLING PROGRAM

- Soil
  - Prevent direct contact
  - Risk-based site-specific standard protecting surface water and groundwater
  - Potential re-grading soil/slopes
  - Appropriate cover/capping
  - Environmental Covenant
  - Soil Management Plan

LAND RECYCLING PROGRAM

- Groundwater
  - Closure under a Site-Specific Standard - Pathway specific evaluation
  - Calculate groundwater to surface water pathway values
  - No action necessary since no pathway/use of groundwater
  - Attainment sampling
  - Environmental Covenant

INITIAL CONDITIONS

REDEVELOPED SITE CONDITIONS

STREAM CULVERT

GEO SYNTHETIC LINER

CULVERT AND BRIDGE

SITE OVERVIEW

CURRENT RESULTS

- Successful recycling of industrial property
- Safe redevelopment and use of the property
- PADEP approval of Act 2 implementation
- Economic benefits of proposed new project